PORTO RICO AGRICULTURAL EXPERIMENT STATION
MAYAGUEZ, P. R.

Under the supervision of the
UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT OF THE PORTO RICO AGRICULTURAL EXPERIMENT STATION

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PORTO RICO AGRICULTURAL EXPERIMENT STATION, MAYAGUEZ

[Under the supervision of the Office of Experiment Stations, United States Department of Agriculture]

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REPORT OF THE DIRECTOR

By D. W. May

Although Porto Rico was settled by Europeans a century before permanent settlements were established on the mainland, the agriculture of the island was in a low state of development when the agricultural experiment station was established in 1902. As a consequence, the experiment station was unable to confine its efforts to research, which is its legitimate function, and was of necessity forced to do much pioneering work in the introduction of new methods, growing of new crops, and improving old ones. With the establishment of the insular department of agriculture in 1917 and the development of its resources and capabilities, it gradually became possible for the station to turn over to the new department the extension activities and to devote its energies to problems of research connected with tropical agriculture. That progress has been made and Porto Rico agriculture is on a higher plane than formerly is abundantly shown in the great increase noted in all lines of agricultural production.

The cost of research is increasing, although the income of the station is almost stationary. Research in tropical agriculture is comparatively new, and there are no limits to its possibilities. Men are desired at the station for urgently needed investigations, and when secured they should be encouraged to remain with the work until the problems are solved. This will require a larger income for equipment and salaries than has been given the station.

No essential changes were made during the year in the lines of work of the station. A new department was established, with Dr.

Gerard Dikmans at its head, to carry on research with parasites affecting domestic animals. On account of the presence of certain diseases, the successful raising of pigs, goats, and chickens is made very difficult.

W. V. Tower, entomologist of the station for some years, resigned to accept a position at a higher salary with a corporation engaged in growing and manufacturing tobacco. Mr. Tower's work with the cigar beetle was so successful that certain private tobacco concerns found it profitable not only to follow his methods but to employ him to carry them out.

Thomas Bregger, plant breeder, resigned to accept a similar position with the Argentine Government. Robert L. Davis, formerly connected with the Bureau of Plant Industry, Fiber Investigations, United States Department of Agriculture, and later privately engaged in breeding flax, was appointed plant breeder.

W. P. Snyder, assistant plant breeder, resigned to continue his collegiate studies at the University of California.

SUGAR CANE

Considerable time was devoted to sugar cane, the leading crop of the island. The entrance of sugar duty free to the markets of the mainland has, in many instances, induced planters to grow cane to such an extent as to neglect rational systems of cultivation. Large mills are necessary in cane production, and when cane lands are devoted to other crops this valuable equipment is likely to lie idle and to deteriorate. Cane will therefore continue to follow cane, and problems arising in connection with its cultivation will have to be solved not so much by changing the crop as by changing the variety on a given area or the system of fertilization. Results obtained at the station show that, next to the practice of rotation, a change of varieties is advisable. Growing immune varieties proved to be the most successful means of combating the mosaic disease, which for a time threatened the sugar industry. At the time the disease became pronounced the station distributed over the infected areas immune or highly resistant varieties which were obtained from various sources. The work of the station in averting complete ruin of the crop was appreciated by cane growers in the section receiving the greatest benefit from the introduced varieties, as was shown by their presentation to the station of a cup, and a memorial reading as follows:

MEMORIAL OF THE AGRICULTURISTS OF THE WESTERN PART OF PORTO RICO TO THE PORTO RICO AGRICULTURAL EXPERIMENT STATION

Whereas the sugar industry in this part of the island was menaced with ruin on account of the mosaic disease, which had invaded its cane fields;

Whereas the Porto Rico Agricultural Experiment Station, of the United States Department of Agriculture, introduced in 1919 some barrels of cuttings of Uba Natal cane, commonly known as Kavangire, or Japanese cane, which is immune to this disease:

Whereas from these seeds were propagated the extensive cane fields now existing in all this region and the industry was thus saved from destruction: Be it therefore .

Resolved, By the undersigned, to present this memorial to the Porto Rico Agricultural Experiment Station in testimony of gratitude and in remembrance of the success achieved in the furtherance of its honor and of our welfare.

Mayaguez Sugar Co. (Inc.); M. Fajardo; Enrique Vivoni; Juan Ortiz Pericchi; Central Eureka (Inc.), M. Fajardo, President; Central Coloso (Inc.), Gmo. Cabrera; Ana Maria Sugar Co., pp. R. Valdés; Sucs. de R. Valdés, R. Valdés; Enrique Lopez Delgado; Juan A. Monagas; Juan Angel Tió; Alfredo Ramirez; Russel & Co., Sucs. S. en C.; Sucs. de Bianchi; Jaime Annexy, jr.; Celedonio Carbonwell, pp. Manuel Alcaráz; Rodolfo Colberg; Juan Acarón Correa; Clemente Javierre.

These so-called Japanese or Indian canes are not of the highest quality, but were used as emergency canes to ameliorate the conditions which were brought about by the mosaic disease. The station is endeavoring by breeding and importation to establish resistant canes which will be richer in sucrose and can be harvested at less cost than those now under test. The results are most encouraging, some of the hybrids proving not only immune, but easier to mill and of a higher quality than are the Indian canes. The greatest contribution the station can make the sugar industry is through breeding canes of higher tonnage, greater sweetness, and resistance to disease. Thousands of seedlings are bred annually, and some of them are of outstanding merit. The highest yield on the island, at the rate of 8½ tons of sugar per acre in one case, and, in another case, 81 tons of cane per acre, was made by the variety St. Croix 12/4, which originated at the Virgin Islands experiment station.

The rapidity with which a new variety of cane can be spread over a given area within a limited time is remarkable. Some of the best varieties have been introduced as single cuttings. A single cutting will produce by stooling 10 to 50 canes, which will mature in the first year. These canes will have sufficiently grown for planting in six months and will furnish 50 to 250 cuttings. Cut again in six months, they will provide cuttings for planting a considerable area. Thus it can be seen how quickly a planter can change his fields to a new and better cane. The station distributes tried and promising varieties in small quantities and without cost to different planters over the island to prove the merits of the variety under local conditions and to encourage planters to grow their own seed cane. This arrangement relieves the station of having to use its limited funds for commercial purposes rather than for experimentation, and it often enables the planter to sell his seed at a higher price than is paid at the mill.

GERMINATING SUGAR CANE

In Porto Rico it is seldom necessary to keep cuttings of cane for any great length of time before planting. Cane growing is a continuous process, the new planting being made as the old one is cut. However, only sound, clean cuttings should be planted, and these should be given a quick start to enable them to make good growth. Too frequently the cane borer (*Diatræa saccharalis*) is introduced with the cuttings. All infested cuttings should be soaked in a solution before planting. The solution readily enters the channels left by the borer and drowns it. This alone would justify soaking

the seed before planting, even when the borer is present in only small numbers. If there is added to the solution an element which is stimulating to plant growth, the crop will not only be free from borers but will make an increased growth. A series of experiments was made at the station to determine the effect on germination and growth of soaking cane cuttings in solutions of various kinds. Prior to planting, the cuttings (seed) were soaked for 24 hours in water, saturated limewater, and limewater and magnesium sulphate. The water-soaked seed gave a germination of 86.42 per cent, the dry-planted seed only 81.41 per cent. A still higher germination, 93.03 per cent, was made by the cuttings which had been soaked in limewater. At the end of three months the dry-planted cane had made a growth of 164 inches, the water-soaked 180 inches, the limewater-soaked 202 inches, and that soaked in limewater and magnesium sulphate 220 inches. The final yields of the plats were as follows: Cane, planted as cut, 58.7 tons per acre; soaked in water, 71.9 tons; soaked in limewater, 72.5 tons; soaked in water containing lime to saturation and 1 pound of magnesium sulphate to 50 gallons, 85.4 tons. The increase in growth of the soaked over the dry-planted cane was due not only to the destruction of the borer but also to the influence of moisture on germination. Where chemicals were used in addition to the water, there was a neutralization of the cane juices which tended to prevent their rapid fermentation and to conserve their stored food, to be used by the growing plant as needed.

LIVESTOCK

The livestock of the island, especially the dairy cattle, are increasing in numbers and in quality, partly through the introduction of purebred animals and partly through crossings of the native stock with improved sires, as exemplified by the station. As a result of judiciously crossing native cows with purebred bulls, the station has developed a herd some of which carry fifteen-sixteenths Guernsey blood. Dairy capacity has increased with each succeeding generation. The native cows of the foundation herd yielded on the average 8.09 pounds milk per day per cow; the second generation (half-bred cows), yielded on the average, 11.9 pounds per day per cow; and the third generation (three-quarters bred), 13.5 pounds per day. (Fig. 1.) This shows an increase of 47 per cent for the half-breds over the native, and 13½ per cent gain for the three-quarters bred over the half-bred. The results have been so favorable and at such a small risk of loss that planters are advised to import only bulls for breeding up the native stock. Both sexes can be acclimated by careful handling, but under the present conditions and methods of management it is best to confine the purchase to the best bull obtainable. Purebred herds can be introduced when the cattle tick has been eliminated and the farmer is prepared to give his cattle good stabling and feed.

The station now owns three purebred Guernsey bulls from dams that have yielded 12,000 to 13,000 pounds of milk annually. These bulls are well fed, and kept stabled except when they are made to work for exercise. Young bulls should be broken to work with native oxen. Work gives them needed exercise and likewise helps in their maintenance. Purebred bulls are supplanting native work cattle in

all farming operations at the station. During the year 79 cows, in addition to those at the station, were bred to these bulls.

Dairy practices are improving. Fresh milk continues to bring relatively high prices, retailing in Mayaguez at 20 cents per quart. A surplus of this commodity could perhaps be used to best advantage in the form of cheese for home consumption and for the local market. Canned dairy products find a ready market in Porto Rico, but they never equal the fresh article. The value of cheese imported into the island in 1921 was $777,638. With the establishment of a race of cattle giving larger milk yields than are now obtained and the successful growing of forage crops, assuring a plentiful supply of nutritious feed for the cattle, there should be rapidly developed a profitable cheese-making industry which will be comparable with that of any other country.

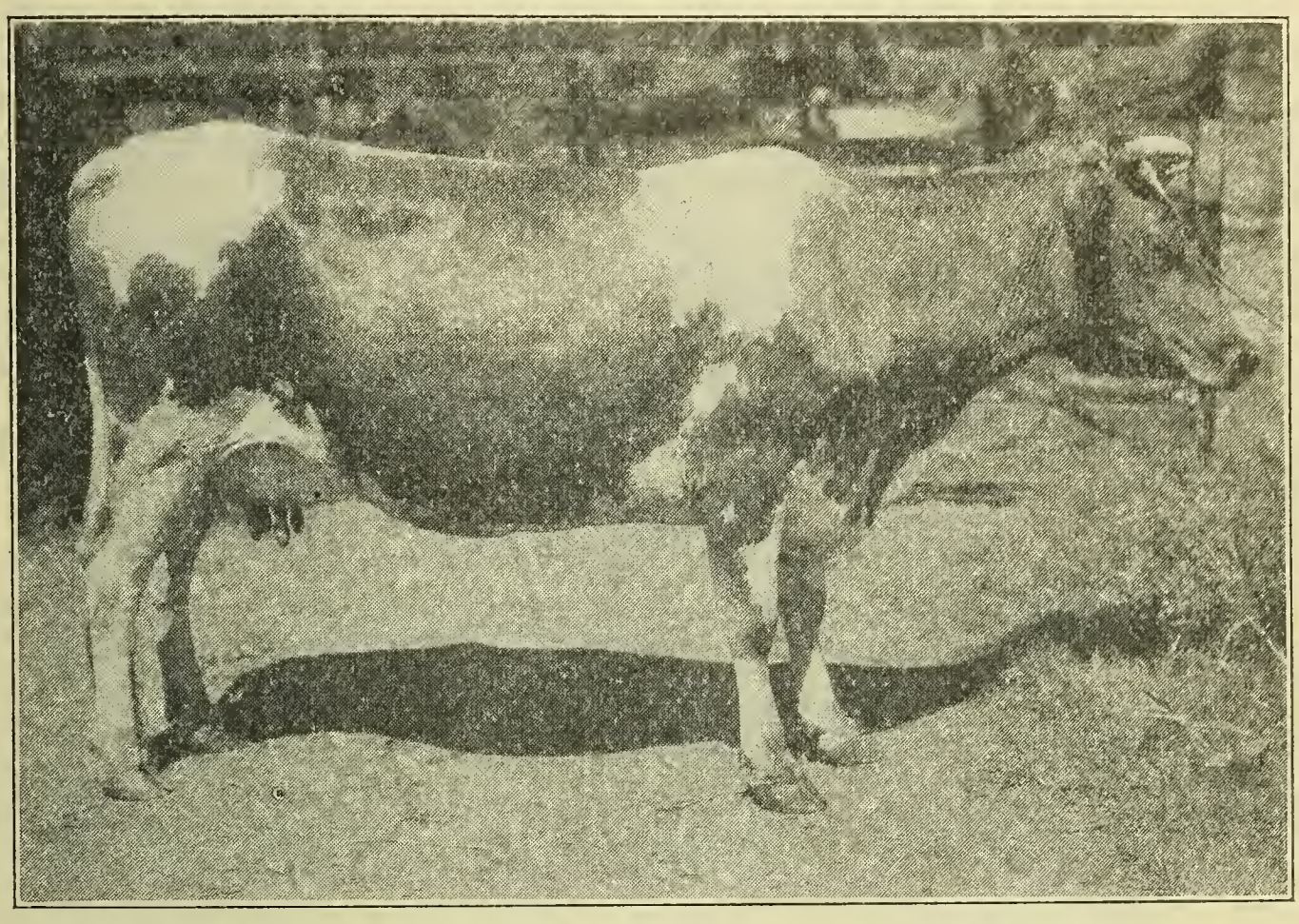

FIG. 1.—Three-fourths grade Guernsey cow. Milk yield 5,000 pounds, butterfat 300 pounds, per year

An increase in the production of forage grasses is primarily the cause of the increase in the number of cattle now found on the island. To promote the livestock industry, the stockman must grow an abundance of feed for his herd. Elephant grass, Guatemala grass, and velvet beans make rapid growth, are greatly relished by cattle, and have high value as stock feed. Such crops are converted into beef, milk, and butter, with the least expenditure of energy and money.

SILOS AND SILAGE

The station built the first silo in Porto Rico in 1908. Since then a number of silos have been erected, especially along the south slope, where the rainfall is deficient. Corn, cane, malojilla grass (*Panicum barbinode*), elephant grass (*Pennisetum purpureum*), Guatemala grass (*Tripsacum laxum*), velvet beans, and cane tops have been

ensiled at the station. Corn made the best silage, comparing in flavor and palatability with that made in the Temperate Zone. Cane came next, but gave trouble during the fermentation process. Its high sugar content is conducive to the production of alcohols and acids, and the processes are difficult to halt. Even with cane tops, fermentation passed from the alcoholic to the acetic stage when there was too much moisture, and it did not take place at all when the tops were too dry. The grasses and velvet beans made poor silage, due largely to the fact that they are too light to pack well unless heavily weighted. The grasses lacked sufficient juice to ferment well, and the resulting product was dry and developed a musty odor. The velvet beans were juicy enough, but they were either not of the proper composition or the proper quality for silage making, and the resulting product was black and unsavory.

Cattle differ markedly in their liking for silage, some taking readily to it and others scarcely at all. It is probably eaten more readily in the Temperate Zone because it is usually fed in winter, when no green fodders are available. Silage is of doubtful value at the station, where the annual rainfall is fairly well distributed, and green forage usually available throughout the year. Even when it was well made the station animals ate it with reluctance, wasting 75 per cent of the grasses and 55 per cent of the sugar cane. Results of experiments show apparently no difference between silage made in the Tropics and that made in the Temperate Zone. Corn silage has been carried over at the station for two years with good results.

PEAS

Peas are not found in the markets or even in the home gardens of Porto Rico, and attempts to grow them at the station were unsuccessful until they had been inoculated with the proper nodule-forming bacteria obtained from the United States Department of Agriculture. Since then a large number of garden and flowering varieties have been grown with ease. Dwarf and climbing peas grow equally well, but the latter make larger yields and over a much longer period. They should be given support, preferably with bamboo stakes or woven-wire fencing, to make the best yields. Many varieties of sweet peas grow well, but the late or summer-flowering sorts fail to bloom, very probably because of the small variation in the length of day in the Tropics. The early-flowering sweet peas bloom profusely; however, they do not make so large a vine growth as the summer-flowering varieties. Peas may be grown in young cane, both plant and ratoon, and are adapted to growing with corn. The crop provides excellent forage for the work animals, and even when not harvested will greatly improve the soil for cane growing. Pea seed should be inoculated with nitrogen-fixing bacteria before it is planted, or else it should be mixed with inoculated soil, which can be obtained from the station for the purpose. After the soil is once inoculated, the process need not be repeated.

REFORESTING

During the year 60 acres of land were planted with seeds and seedlings less than a year old of many forest trees, including palo

de Maria (*Calophyllum calaba*), caoba (*Swietenia mahagoni*) (fig. 2), maga (*Thespesia grandiflora*), ipil-ipil (*Leucæna glauca*), obtained from the Philippines, flamboyan blanco (*Bauhinia kappleri*), acacia amarilla (*Albizzia lebbeck*), *Eucalyptus robusta*, and Australian pine (*Casuarina equisetifolia* and *C. cunninghamella*), the seed of which was introduced. Approximately 10,000 mahogany trees and others of economic importance are now growing on the 200-acre tract on the mountain overlooking Mayaguez. Palo de Maria makes the best growth under the most adverse conditions, is valuable as a cabinet wood, and can be recommended for commercial planting.

The soil on which the forest trees have been planted is very variable. At the station proper, it is an undulating clay of average

FIG. 2.—Mahogany trees 15 years old on the Mesa, near Mayaguez. Elevation, 1,000 feet

quality; and, on the area ranging from 500 to 1,000 feet above sea level, where the greater part of the plantings are, it is for the most part ferruginous, in places consisting of more than 50 per cent ferric oxid. In these places, it is difficult to get anything to grow. Results of experiments at the station indicate that legumes may be grown with advantage on reforested areas. Nurse crops, such as the pigeon pea or the dwarf bucare (*Erythrina berteroana*), which grow readily from cuttings, are especially valuable for reclaiming badly washed soil and windswept ridges. They not only store nitrogen in the soil but also furnish temporary wind and sun protection for the more tender seedlings. A nonclimbing legume is perhaps best as an intercrop for young trees. Crotalaria is very good for the purpose, and can be followed by velvet beans when the trees are past danger of being smothered out.

REPORT OF THE ASSISTANT CHEMIST

By J. O. Carrero

No new work was started in this division, it being expected that every available facility will be taxed to the utmost when the crops are gathered. Certain material of a highly perishable nature will require immediate attention, and the composition of the soils under treatment will need to be determined as soon as samples are taken.

MANAGEMENT OF CANE SOILS

The study of nitrogen utilization by cane soils was continued. The first ratoon crop was cut early in the year, and the residue, after being allowed to dry, was either incorporated with the soil or burned off, depending upon the kind of treatment given each plat. Samples were taken of soils to be limed, and the plats were given the required treatment, followed by plowing and the planting of a leguminous cover crop which was turned under. Later, the land was disked and harrowed and in July was planted with cane. Certain of the plats were fertilized with nitrogen in the form of nitrates three weeks later, and others were left to serve as checks. Early in the experiment, differences in height and color of plants were observed between the nitrogen and the control plats, and small differences in height but marked differences in color were apparent between the sodium nitrate and the ammonium-sulphate plats. At present, 13 months after planting, hardly any difference is to be seen either in height of cane or color of leaves, regardless of the form of nitrogen applied, while large differences, both in height and thriftiness of plants, are noticeable between the nitrogen and the control plats.

In a series of experiments made to determine the comparative yields of cane plats under different treatments, certain sections (series A, C, and E) were limed, and others (series B, D, and F) were left unlimed to serve as checks. Plats Nos. 1, 2, 3, and 4 of the C and D series were treated with nitrogen as sodium nitrate at the rate of 60 pounds per acre; plats Nos. 5 and 6 of the C and D series were given nitrogen in the form of sodium nitrate at the rate of 30 pounds per acre: plats Nos. 1, 2, 3, and 4 of the E and F series received 60 pounds of nitrogen as ammonium sulphate; and plats Nos. 5 and 6 of the E and F series, nitrogen in the form of ammonium sulphate at the rate of 30 pounds per acre. No plats in the A and B series received nitrogen. In plats No. 1 of all the series the trash was burned, but no legumes were planted; in plats No. 2 the trash was burned and legumes were planted and plowed under; in plats Nos. 3 and 5 the trash was plowed under, but no legumes were planted; and in plats Nos. 4 and 6 both the trash and the legumes were plowed under. The following table gives the results of the test:

Comparative yield of cane plats under different treatments

Plat series	Plat number	Plant cane per acre	Cane per acre from first ratoon	Available sucrose per acre from plant cane	Available sucrose per acre from first ratoon crop
Limed:		*Tons*	*Tons*	*Tons*	*Tons*
A	1	25.29	20.74	3.537	2.188
	2	28.36	22.02	3.880	2.853
	3	24.78	18.00	3.466	2.171
	4	25.17	26.50	3.378	3.136
	5	10.50	21.93	1.242	2.327
	6	19.29	25.12	2.384	2.625
C	1	41.58	21.37	4.700	2.827
	2	48.52	36.25	5.804	4.510
	3	43.20	28.63	5.752	3.526
	4	46.34	33.47	5.061	3.756
	5	38.14	20.64	4.726	2.319
	6	37.58	29.62	4.669	3.393
E	1	38.62	20.52	4.648	2.458
	2	47.58	30.06	5.507	3.006
	3	42.42	23.76	5.553	2.713
	4	40.78	30.37	4.973	3.708
	5	34.87	27.15	3.738	3.232
	6	36.35	34.07	4.660	4.227
Unlimed:					
B	1	37.99	23.18	5.233	2.965
	2	37.34	25.60	5.087	2.960
	3	33.47	21.10	4.204	2.403
	4	37.05	29.48	4.771	3.146
	5	32.33	17.91	4.243	2.208
	6	35.94	28.75	3.783	3.394
D	1	43.12	24.39	5.418	3.000
	2	49.83	33.42	5.807	3.700
	3	40.70	27.68	5.000	3.405
	4	47.84	35.45	5.400	3.841
	5	39.16	27.52	4.792	3.276
	6	43.10	38.74	5.505	4.748
F	1	38.70	38.28	4.427	4.230
	2	42.16	33.76	5.243	3.208
	3	44.72	30.15	5.274	3.373
	4	35.33	37.80	4.405	3.023
	5	42.76	22.60	5.433	2.540
	6	37.12	27.13	4.214	3.500

Velvet beans and cowpeas have been the only crops so far tested in this experiment to determine the extent to which they utilize atmospheric nitrogen. Cowpeas, velvet beans, *Crotalaria* sp., and sweet clover are also to be tested further. Comparative tests are under way to determine the amount of nitrogen and other fertilizers removed by the crop and the effect of the treatment applied on soil composition.

EFFECT OF SULPHUR AND SULPHUR COMPOUNDS ON PORTO RICAN SOILS

Results of preliminary experiments with sulphur and materials carrying sulphur in soluble form failed to indicate any increase in plant growth due to added sulphur. In comparative tests, made on a red clay soil, with and without the addition of lime, native bat guano was found to contain enough sulphur in soluble form to more than satisfy the needs of the plants. In a second test the fertilizers applied lacked sulphur either in a soluble or insoluble form in the control pots. The test pots were treated with sulphur or calcium sulphate to observe their effect on plant growth. Sulphur failed to produce any increase in yield regardless of whether the soil was limed or unlimed when nitrogen and potash were the fertilizers

added. Calcium sulphate failed to bring about any increase in yield in the unlimed pots, but doubled it in the limed pots. When phosphoric acid was used with nitrogen and potash the addition of calcium sulphate always produced an increase in yield, the limed pots producing the largest increases. When no sulphur was used the yield of the limed pots was below that of the unlimed pots. However, the addition of calcium sulphate to the limed pots produced a yield which fairly equaled that in the unlimed pots.

ANALYTICAL WORK

Irrigation and drinking waters, feeds, fertilizers, minerals, and other materials sent in from various sources were analyzed when it was thought the results would be of general interest or importance. Analytical work was also done for the other departments of the station, including the analysis of the juices of recently introduced varieties of cane and seedling canes for the assistant horticulturist. Comparative studies were made of the composition of the juices of Uba cane and Java Unknown when the crops were harvested at different periods of maturity, and of the deterioration occurring in the juices after the canes were cut and left on the field for several days. Notes were made of the changes in the Brix hydrometer reading of the juices, sucrose content, purity of juices, reducing sugars, and quantity of juice extracted from the canes under similar conditions.

REPORT OF THE HORTICULTURIST

By T. B. McClelland

EFFECT OF VARIATION IN DAY LENGTH ON GROWTH OF CERTAIN PLANTS

A large part of the year was devoted to a study of the effect of variation in day length on blossoming and growth of certain local plants. A June day length in this latitude, 13.2 hours, was found to be too long, and one of 10 hours too short, to induce blossoming of *Tephrosia candida*, a tropical legume which is used as a cover crop. Shortening the day from the long day of summer to a 12-hour length promptly induced blossoming, whereas a continuation of exposure to the long summer day inhibited it. Heavy blossoming was induced out of normal season through artificial manipulation of the length of daily light exposure, and growth as well as blossoming was affected to a pronounced degree, the longer day producing growth with longer internodes and larger leaves. Miscellaneous plants, which were grown under day lengths approximating those of June and December in this latitude, showed pronounced and interesting differences in behavior. The day was shortened to 11 hours for one group and lengthened to 13⅓ hours for the other. Although planting may be made every day in the year in Porto Rico so far as the temperature is concerned, plant growth is influenced to such an extent by any variation in normal day length as to make the planting season in many instances the deciding factor for success or failure.

Bermuda onions, grown under the short winter days, were transferred from the field while still in the "spring onion" stage, three months after planting. Thirty-three days later the bulbs in the long-

day group were more than twice as large as those growing under the reduced day length. Roselle showed buds at 4 weeks after planting under the short-day length, carried large red fruits, though only 5 inches high, at 10 weeks, and matured seed at 14 weeks. These plants remained about 5 inches high. Of the plants which were kept under the long exposure for 5½ months, the tallest attained a height of 36 to 45 inches, and none showed a tendency to blossom. These plants were still growing vigorously when those under the artificially shortened day, having fruited, were dying. (Fig. 3.) Small radishes which were taken from the field and placed in the two groups showed differences as early as 8 days after setting. The effect of day length was here most pronounced, much larger leaves and roots developing under the longer exposure to light. Zinnias blossomed under both exposures but showed decided differences. Under the shorter day they blossomed at 5 weeks, but under the longer day they required about 8 weeks. Under the short day the plants were spindling and produced numerous blossoms, whereas under the long day they grew more vigorously, attained a greater height, and had broader leaves and fewer but larger blossoms. The long day inhibited blossoming in cosmos, while the short day produced small, spindling plants which opened their first blossoms at 39 days after the seed was planted. Poinsettias behaved similarly. (Fig. 4.) Biloxi soy beans opened the first blossom at 30 days after planting under the short exposure and at 47 days under the long exposure. The former carried good-sized, well-filled pods at 2 months, while the latter, although blossoming, were as yet setting no pods. Seed matured in less than 3 months under the short exposure and the dwarfed plants at 3½ months, with crop matured, retained few leaves, made no further growth, and soon died. Five months after planting the plants under the long day were large, well foliated, and bore pods turning from green to brown. The height attained under the short day was approximately 1 to 1½ feet and under the long exposure 3 to 3½ feet (fig. 5). *Tithonia rotundifolia* developed much more rapidly under the short day. Two weeks after the plants were placed in the two groups, those under the short exposure showed an average increase in height of 8 inches, in contrast with an increase of 2 inches under the long exposure. Seed matured under the short exposure before the first blossom opened under the long exposure.

CROTALARIA SPP. AS COVER CROPS

Tests are being made with *Crotalaria* spp. to determine their efficiency as cover crops, and seed of the most vigorous growing species is being distributed to those desiring it.

ROOT CROPS

Sweet potatoes.—Approximately 40 varieties of sweet potatoes from both continental and insular sources have been under test at the station during the past four years. These have now been reduced to one of the local "mamey" or orange-fleshed varieties and nine varieties which were imported from the north, and they are considered best from the standpoint of yield and quality. Annual plantings for comparative purposes are made in 50-foot rows spaced 5 feet apart. Key West and Madeira led in production, each yielding at

the rate of little more than 15 tons per acre (fig. 6). A still higher yield—260 pounds, or at the rate of approximately 22½ tons per acre—was obtained from a 50-foot outside row of Key West, which,

FIG. 3.—*Effect of length of daily illumination on roselle plants. At right, illuminated equal to June days; at left, equal to December days*

because of its position, was not included in the comparisons. Owing to their superior table qualities and consistently high yields throughout the tests, one or the other of the varieties leading in production

FIG. 4.—Poinsettia plants. Right, short-day illumination; left, long day

FIG. 5.—Biloxi soy beans. Right, short-day illumination; left, long day

each year. Key West and Madeira are unqualifiedly recommended for general planting. Extensive distributions of these varieties have been made on the island.

Yams.—The yam collection has been reduced to 6 varieties which have shown themselves most valuable for this locality. Purple Ceylon led in yield, producing on the average 4 pounds 14 ounces per hill, and was closely followed by the Potato yam, with an average of 4 pounds 6 ounces per hill. The heaviest single tuber was produced by *Dioscorea alata* (S. P. I. No. 47001) and weighed 15 pounds 13 ounces.

Yautia.—To determine the effect, if any, of the form of the seed on the yield of yautia, the horticulturist planted differently shaped seed pieces of 9 varieties, using elongated tubers, short plump tubers, and tops and other cut sections of the rootstock. The pieces were as

FIG. 6.—Variety test of sweet potatoes. Key West, variety in center, yielded at the rate of over 15 tons per acre

nearly uniform in weight as possible, those of 8 varieties weighing between 70 and 110 grams and of the other variety between 60 and 100 grams. The total difference in weight of the crops from the different kinds of seed was found to be only 19 per cent, the elongated tubers leading in production, and the cut sections of the rootstock ranking lowest. The heaviest yields in 5 varieties were from elongated tubers and in 4 varieties from short tubers, the difference in weight of the totals of the two forms amounting to 10 per cent. Heavier yields were obtained from the tops of rootstocks than from the lower sections for 6 varieties, and the opposite was true for the 3 other varieties. No definite, consistent correlation was apparent between the form of seed piece planted and the weight of the crop

harvested, the elongated tubers leading in 3 cases, tops in 3, cut sections in 2, and short tubers in 1; and the elongated tubers ranking lowest in 2 cases, tops in 1, cut sections in 4, and short tubers in 2.

Dasheen and taro.—With dasheen and taro the effect of size of seed piece on the resulting yield was pronounced for the tests as a whole and consistent for each variety tested. In four varieties tubers weighing between 70 and 100 grams were used as small seeds, and tubers weighing between 140 and 200 grams as large seeds. Seed for two other varieties was slightly smaller but similarly contrasted as to relative size. At harvest time the yield from 10 seed pieces of each variety was weighed. The total increased yield from the planting of large tubers was 17 per cent and amply repaid the greater initial cost of the larger seed.

The Penang taro has demonstrated its excellent table quality and also its very poor keeping qualities. It is a highly desirable variety for the home garden, but its perishability is greatly against it as a commercial product, a large percentage of the corms rotting within a week after digging.

AVOCADO

Of the various methods of propagating the avocado, those described as slot grafting [1] and bottle grafting [2] may be of interest to avocado growers in Porto Rico. In slot grafting (fig. 7) the scion is tapered to a wedge shape with a long, oblique cut, and then inserted under an upright tongue of bark which has been cut to fit closely, both tongue and scion being held in position by a fine brad driven through the graft into the wood of the tree. The scion and exposed surfaces are then coated with paraffin, which is sufficiently warm to spread. In bottle grafting, an oblique slit is made well up on a long scion, which is then placed saddle fashion on a stock that has been cut in the form of a wedge, the union being secured by waxed tape. The base of the scion is immersed in water until the new growth has developed and hardened. (Fig. 8.)

COFFEE

Fertilizer experiments with coffee were carried on as previously outlined. Potash and nitrogen continue to show themselves more effective than acid phosphate in increasing yield, the former each appearing seven times and the latter three times in the fertilizer combination applied to the 10 plats making the best yields of the 40 included. In a cooperative experiment a 7:7:7 fertilizer gave a substantial increase in crop in the past year following semiannual applications at the rate of 350 pounds per acre. In experiments comparing sulphate of ammonia and nitrate of soda in combination with acid phosphate and potash, plats receiving the former yielded in the 1923 crop 7¼ liters of cherries per tree, whereas those receiving the latter produced 4½ liters, which is in accord with their previous performance. An extensive pot test has been begun to investigate further the apparent superiority of sulphate of ammonia over nitrate of soda as a fertilizer for coffee. Applications of nitrate of soda are made semiannually in some instances and monthly in others, and with and without sulphur, all with corresponding checks.

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[1] Jour. Heredity, 14 (1923), No. 9, p. 399. [2] Idem., No. 4, p. 171.

HIBISCUS

Over 500 hibiscus seedlings, some of striking beauty, are growing at the station. Most of them are the result of crosses between recently imported and locally grown varieties, and approximately 100 are the progeny of a Hawaiian introduction (Hawaii Sta. No.

FIG. 7.—Slot-grafted avocado, 140 days after placing scion

205:2) pollinated with *Hibiscus schizopetalus*. The former bears small white to straw-yellow flowers in which the eye is carmine, and the latter flowers shading from bright rose to carmine. The seedlings from this cross are of very vigorous habit and show a wide

range of growth, foliage, and form and color of flowers, the latter ranging from very pale tints of pink and salmon through the scale to red and carmine. The range in variety would seem to fall not far

FIG. 8.—Bottle-grafted avocado, 50 days after placing scion

short of the number of individuals, involving in the flower, size, shape, scalloping of petals, absence or presence and size of eye, tinting or shading and blending of colors on both upper and under surface of petals, and color of stigma. (Fig. 9.)

REPORT OF THE ASSISTANT HORTICULTURIST

By José A. Saldaña

SUGAR CANE

Two recently introduced varieties of sugar cane—B 14761 and Mauritius Seedling—show considerable susceptibility to the mottling and root diseases. The variety E. K. 28 from Java continues to do

FIG. 9.—Flowers of Hibiscus crosses. Flowers of parent species at top

well, although it requires very well-drained soil for best development. Another of the introductions is an unidentified variety called "Java Unknown," which is supposed to have come from Java. It is very similar to Uba, Cayanna–10, and Zwinga, but can be distinguished from them by its swollen nodes, heavier stooling habit, darker green leaves, and by the ease with which it may be stripped. In a comparative test with Uba it yielded 55.52 tons of cane per acre, whereas the Uba yielded at the rate of 49.19 tons. The following table gives the average results of a series of analyses of these two canes:

Chemical analyses and calculated yields of Java Unknown and Uba cane [1]

Name of cane	Brix reading	Sucrose content	Coefficient of purity	Total juice extracted by small mill	Calculated yield of sugar per acre [2]
	Degrees	*Per cent*		*Per cent*	*Tons*
Java Unknown	18.38	14.45	78.60	55.61	5.334
Uba	17.75	14.55	82.36	57.79	5.019

[1] The analyses were made when the canes were about 16 months old.
[2] Calculations based on 76.79 per cent for Uba and 74.61 per cent for Java Unknown, as extracted by the larger mills. The latter variety was little over 2 per cent lower in extraction than Uba.

The variety P. O. J. 2725, a Java cane which was received from Tucumán, Argentina, shows high resistance to the mottling disease and produces a large number of canes to a stool. In general, it is considered a promising variety.

Of the 8,000 seedlings which were set in the field, only 18 were selected for further testing, the others being discarded because of susceptibility to the mosaic disease or of inferiority to the parent varieties. Most of the seedlings were from P. R. 359, which, because of its susceptibility to mosaic disease, does not appear to be desirable for additional breeding work. In the fields of P. R. 359, from which arrows were collected, the mosaic infection was 100 per cent. The resulting seedlings did not develop the disease directly, but nearly all of them got it by secondary infection.

The following list gives the number of seedlings produced by the different varieties in 1924: D 109, 28,000; P. R. 492, 380; B 6308, 151; G. C. 1486, 135; B 3412, 89; S. C. 12/4, 76; Rayada, 63; P. R. 409, 34; E. K. 28, 18; P. R. 449, 9; P. O. J. 36, 5; P. O. J. 105, 2; and F. C. 306, 1. Of a total of 28,963 seedlings, only 2,100 selected specimens were set in the field.

Some of the varieties which were tested between 1920 and 1924 have shown complete or partial sterility. The Uba cane, proving male sterile, was considered adapted to cross-pollination with pollen-fertile varieties. The varieties P. O. J. 36, P. O. J. 105 (Egyptian), and F. C. 306 gave very poor germination. Cayanna–10, D. 433, and Cristalina did not germinate at all. The varieties giving a fairly good germination included E. K. 28, S. C. 12/4, G. C. 1486, B. 6308, P. R. 409, P. R. 449, Rayada, B. 3412, B. 1809, B. 4596, P. R. 292, and P. R. 358. Those giving excellent germination were D. 109, P. R. 359, and P. R. 492.

TOMATOES

Of the varieties tested during the year, Trucker Favorite and Matchless were the most susceptible to bacterial blight, the crop being destroyed before the yield could be determined. Cristobal produced on the average 2.86 pounds of fruit per plant and Hawaiian Hybrid 2.97 pounds, during a comparatively short period, then succumbed to blight. Burpee Self-Pruning produced a fair crop, approximately 2.94 pounds of fruit per plant, but proved susceptible to attack by blight and Phytophthora. Dwarf Stone showed some resistance to blight, and Stark Blight Resister (probably same as Norton), which yielded fairly well, proved markedly resistant to disease, being one of two varieties to yield for the longest period. The varieties Greater Baltimore, New Century, Trophy, Ponderosa, Imperial, Stone, Lares Smooth, and Arlington have been under test for two years. Of these, New Century, Greater Baltimore, Lares Smooth, Stone, Imperial, and Arlington are the best yielders. Hybridization done in previous years included crosses between Prolific and Stone, Greater Baltimore and Lares Native, Arlington and Greater Baltimore, Lares Native and Stone, New Century and Insular Station No. 433, and Insular Station No. 433 and Diener. From the above crosses strains have been selected and tests made each year under adverse and favorable conditions. Of the selections tested this year on land on which several crops of tomatoes had succumbed to blight, the hybrids obtained by crossing Insular Station No. 433 and Diener 1–10 proved to be the most resistant to bacterial blight. This strain is very prolific, yielding at the rate of 3.89 pounds of fruit per plant and bearing large clusters of small-sized fruits which are suitable for marketing. The progeny of Lares Native × Stone, Greater Baltimore × Lares Native, and New Century × Insular Station No. 433, from which the bitter flavor of the native parent has been eliminated, are doing fairly well.

MUSKMELONS

In December, 1923, two selections each, from a native muskmelon crossed with Salmon Tint Pollock and with Casaba, were set in hills 2 feet apart in beds 7 feet apart. The plat was treated with a mixture of sodium nitrate (3 parts), phosphoric acid (4 parts), and potassium sulphate (1½ parts), applied at the rate of 4 ounces per hill, and the plants were sprayed with nicotine sulphate (4 cubic centimeters of the sulphate to 1 gallon of water) for plant-lice control. Cycospora and downy mildew attacked the plants and caused premature fruiting. Seed for further planting was saved from hybrids showing the most resistance to mildew. Notes were taken on earliness, vigor, weight, number, ribbing, netting, and shape of fruit, and color and quality of flesh. One of the hybrids of the native melon crossed with Casaba shows considerable uniformity in plant and fruit characters, but the fruit lacks flavor. A hybrid of the native melon crossed with Salmon Tint Pollock is not only prolific but the flavor of its fruit is all that can be desired. Selected seventh generation hybrids of both crosses, planted in April, 1923, and sprayed with Bordeaux mixture for fungus control, produced fine crops. The fruit of the native melon crossed with Casaba continues to lack flavor,

however. whereas that of the native variety crossed with Salmon Tint Pollock has good flavor and weighs 3 to 7 pounds each. Some of the hybrids inherited the size, shape, and ribbing of the native melon and the sweetness of Salmon Tint Pollock, and others, the shape, netting, flavor, and smoothness of the Salmon Tint Pollock and size which is intermediate between that of both parents. The fruit of the Salmon Tint Pollock weighs on the average 2¾ pounds, and that of the native muskmelon 7 pounds.

SWEET CLOVER

Hubam clover, an annual variety, and Bokhara, a biennial, make thrifty growth at the station, especially during the rainy season. Hubam does well even in the dry season when it is sufficiently irrigated.

PAPAYA

Plantings of papaya seed, from various local sources, are being made to isolate, if possible, a hermaphrodite type yielding a heavy crop of fruit of good quality, uniform shape and size, and proving resistant to nematodes and disease.

REPORT OF THE PLANT BREEDER

By R. L. Davis

FIELD CORN

The material used in the 1924 field-corn experiments consisted largely of ear-to-row selections which were left by the former plant breeder, and ears collected this season from the western part of the island. At the time the collection was being made it was learned that drought had ruined the corn crops in the Lajas district during five successive years. Experiments were therefore started with corn to test its drought-resistant properties. Drought-resistant varieties would be of decided advantage even in the rainy sections of the island, as at the station, where dry periods of five to eight days' duration are likely to occur during the growing season. A short dry period in the Tropics is serious because of the excessive rate of evaporation of moisture from both plants and soil. Porto Rico corn is injured by drought in the seedling stage and in the silk. The seedling stage was chosen as the most convenient one for study. Germination flats were filled with equal quantities by volume of river sand and watered to saturation. From each ear a 50-seed sample was planted an inch deep in rows and kept watered to saturation until the corn was 8 days old. The foliage of half of each sample was cut and weighed separately and the remainder was placed under a glass roof and deprived of water for eight days. Marked differences in ability to resist wilting were noted in the seedlings of the various parent ears. Nor were the differences governed by weight of foliage, several of the strains having the largest amount of foliage by weight resisting wilting several days longer than all others.

It was then thought advisable to determine the extent to which germination under field conditions would confirm results obtained under laboratory conditions. Strain No. 276–19, the second best

yielder in 1923 and a partially drought-resistant sort under laboratory conditions, was used as a control. Seeds of the check variety were sown a foot to the left of each hill of all the ear-to-row selections; hence, at two weeks after planting, each corn seedling could be compared directly as to degree of drought injury with a seedling of the check variety grown practically in the same hill. (Fig. 10.) During June, 1924, when the field planting at Mayaguez was a week old, a drought set in which lasted during the second week and made conditions strongly paralleling those of the artificial drought in the laboratory. Espiral and Gigante, the two most susceptible strains under laboratory conditions, were practically eliminated by the stunting effect of the drought in the field. On the other hand, Cacique–4 and Medio Cacique–6, which withstood the

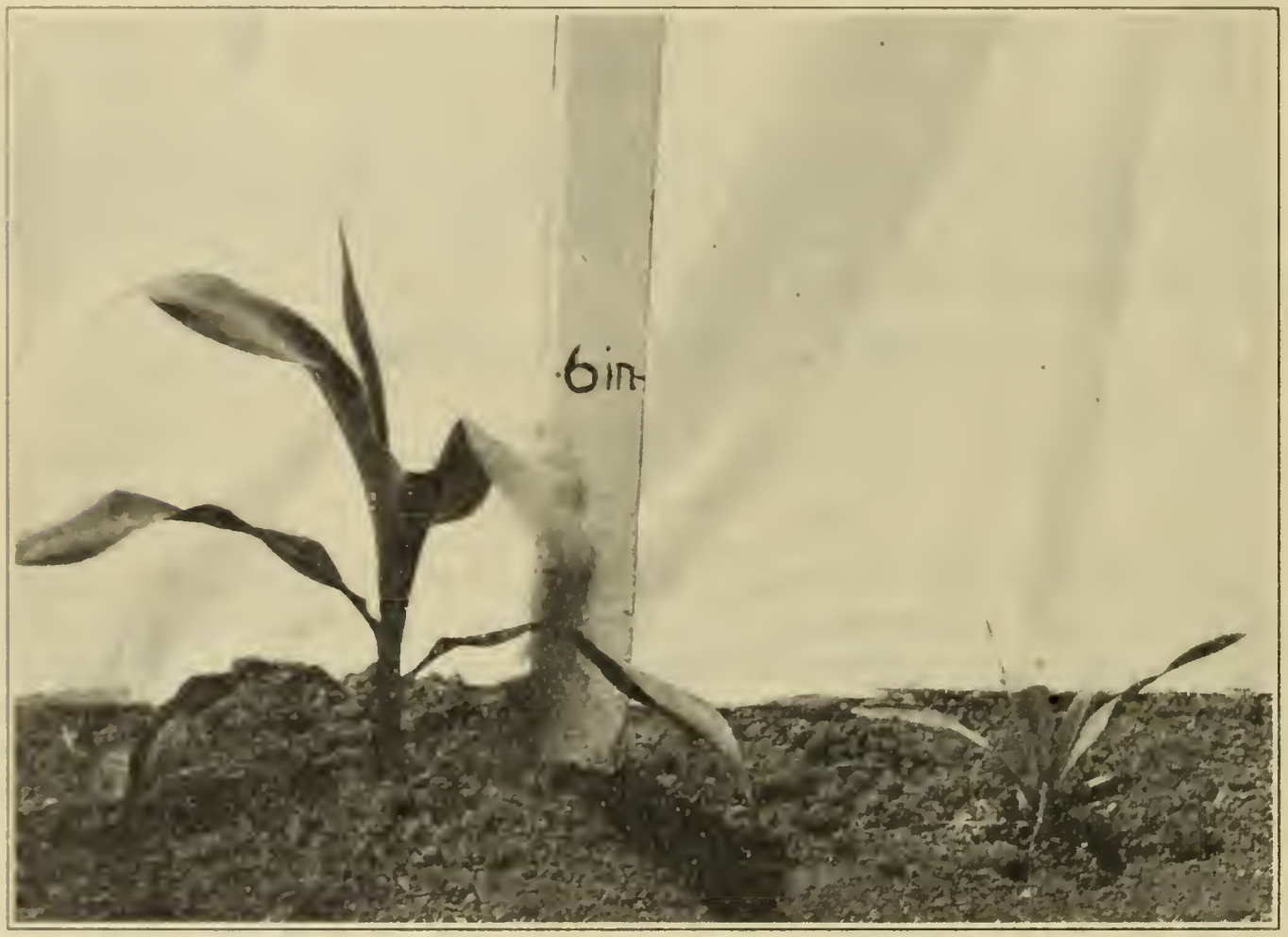

FIG. 10.—Drought injury to corn 14 days old. On right, variety Espiral injured and failed to mature. On left, variety No. 276–19, which escaped with little injury

artificial drought, were scarcely injured by the field drought. Of all the strains tested in the spring parent ear Cacique–1 was the most resistant to drought under both laboratory and field conditions.

The outcome from the yields of shelled corn confirm the fact that ears producing seedlings which wilt readily when deprived of water under laboratory conditions are undesirable for planting. (Fig. 11.) Thus, Espiral and Gigante, which produce strongly susceptible seedlings, yielded 28.4 and 30.8 bushels of shelled corn, respectively, per acre, while Cacique–4 and Medio Cacique–6 yielded 35.7 and 37.2 bushels, respectively. Cacique–1 again demonstrated its superiority over other varieties as a drought resister and yielded 42.2 bushels or over one-third more shelled corn per acre than did either Espiral or Gigante. In fact, Cacique–1 outyielded all the other corn ears tested this season by a clear margin of 5 to 14 bushels.

Cacique–1 was according to appearances the most promising ear selected from the very dry district near Lajas. At one week the root system of Cacique–1 seedlings averaged several inches longer than those of the other ears, including those grown at Mayaguez in 1923 and those selected from the corn fields near Lajas. The foliage of the Cacique–1 seedlings ran one-third to one-half again as heavy as seedlings of other ears. The ear itself, a tapering 12-rowed one with very small cob and very long keystone kernels, was a type much favored by farmers in the Lajas district because of its ability to make a crop during years of drought. The individual kernels were shallow dimple dent with a white cap encompassing on the average about 10 per cent of the kernel. The color of the kernels varied from cadmium yellow to orange (Ridgway's color standard).

Fortunately, on the strength of the favorable appearance of the ear and the vigor of the seedlings, a special breeding plat had been

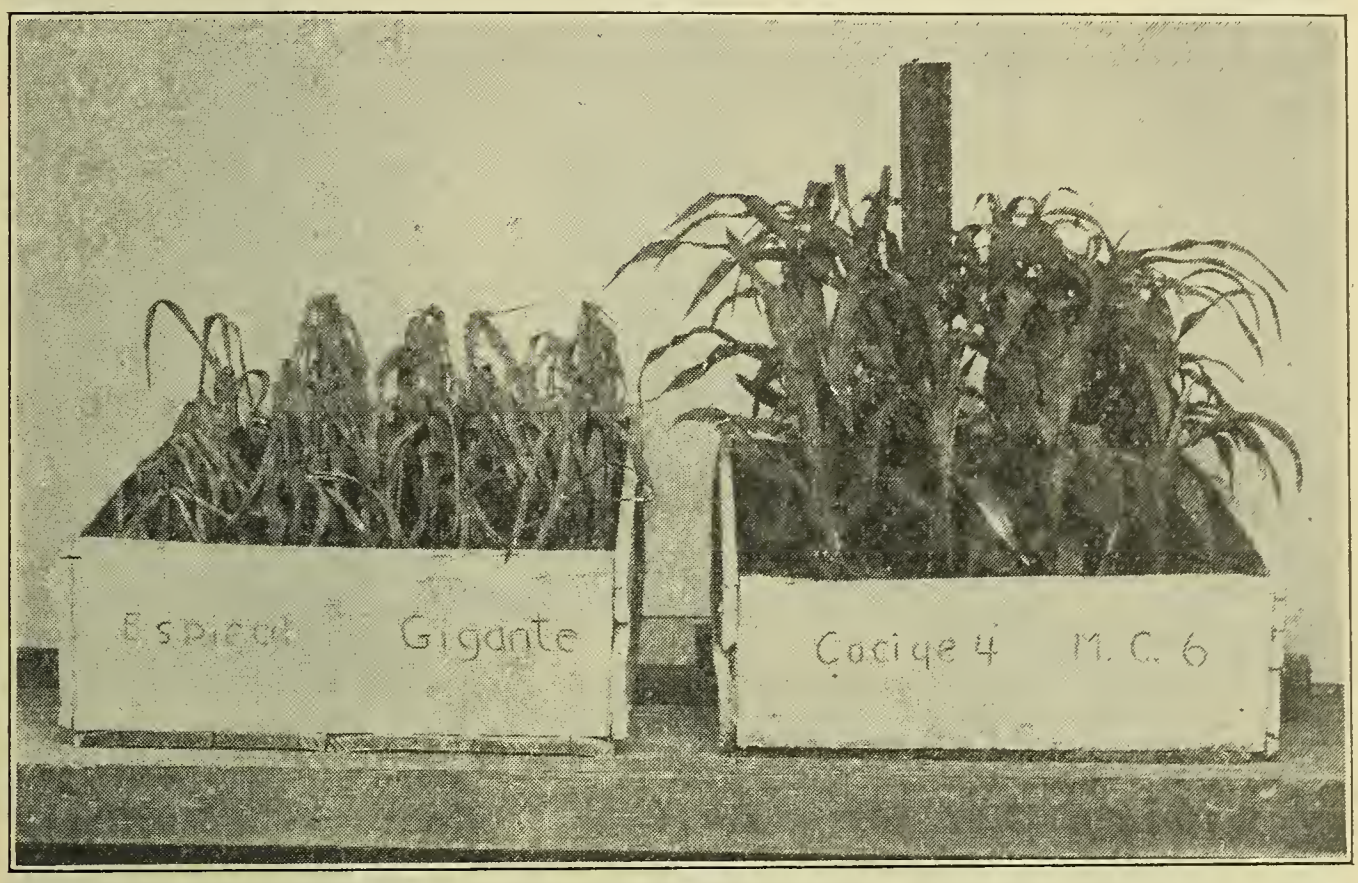

FIG. 11.—Corn 14 days old, one week after being deprived of water. Showing effect on different varieties

planted to Cacique–1 alone long before the yields of shelled corn were available. One hundred and fifty selfed lines of Cacique–1, the best yielder in 1924, have been started and foundation stock for building up a high-yielding variety for Porto Rico is already in the making.

SWEET CORN

The former plant breeder left a number of sweet-corn hybrids with native field corn. All sweet-corn seed failed to germinate excepting sugar kernels from No. 276, a native field corn selected in 1921 from near Lajas. In 1922 several ears from this strain were found with 10 to 20 kernels segregating into sweet and starchy types. It is not known whether the strain is the result of chance pollination from some variety of sweet corn grown in rural school gardens or whether it is a sport or mutation from the native field corn. The sugar kernels from the 1923 crop of these ears were sorted out and

formed the basis for the 1924 breeding work. The samples were rogued in the germination boxes and resulting vigorous seedlings with long roots and healthy green leaves were transplanted to the field. Just prior to tasseling all unhealthy plants were again rogued. The remaining plants reached a height of 6 to 8 feet and produced ears which were 4 to 7 inches long and well filled to the tip with sweet kernels. (Fig. 12.) Introduced varieties of sweet corn do not attain a greater height than 3 to 4 feet and produce ears which are rarely more than 3 to 4 inches long and soon become worm-eaten.

The original crossbreeding work was between Henderson Sugar and a white native field corn. This was run through four genera-

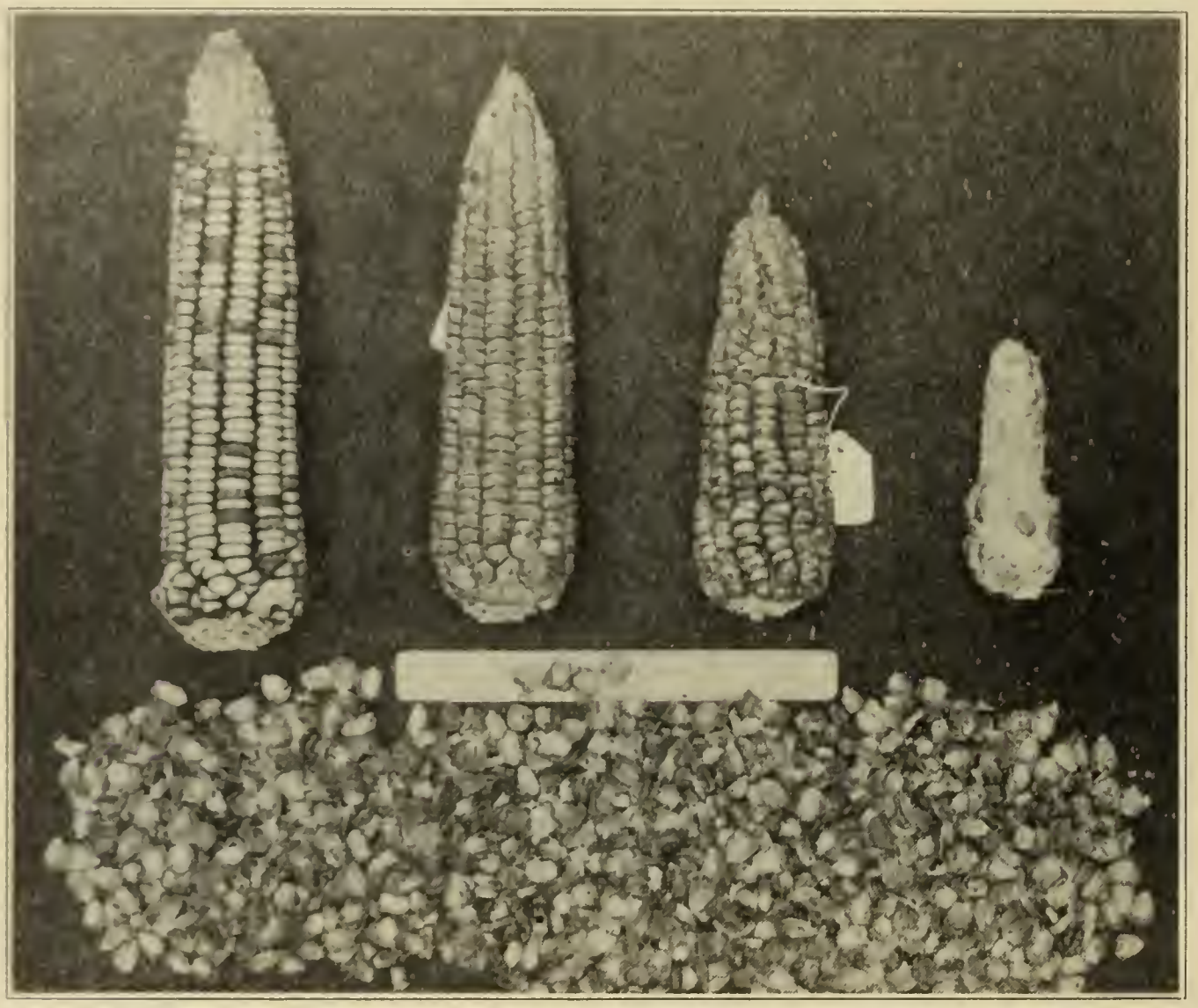

FIG. 12.--Sweet-corn improvement. On right, usual type of sweet-corn ear; left, cross-bred ear; center and below, corn from selected kernels of ear on left

tions and then crossed with a yellow native field corn to improve its vigor. The F_3 generation of this hybrid is vigorous and apparently adapted to the soil and climate of the island.

REPORT OF THE AGRICULTURIST

By H. C. HENRICKSEN

PINEAPPLE INVESTIGATIONS

Pineapple-production investigations were begun in 1922, but received little attention because of the demands made upon the agriculturist's time by other work which had to be finished at once. In

1923, a series of pot culture experiments was started to supplement work in the field, and in 1924 a systematic study was made of various soil, fertilizer, and cultural problems having an important bearing on the pineapple industry in Porto Rico.

SOILS

Pineapple plants on certain areas outwardly manifest the unsuitability of the soil in which they are growing in a lack of uniformity in size and color of plants. This is always apparent a few months after planting, although it may be less so later. The unsuitable areas are not readily discernible until after planting. They usually occur in streaks or patches which are slightly lower than the surrounding areas, and when seen from an altitude of 15 feet or more appear lighter in color than these areas. Investigations are now under way to determine, if possible, in what respects these soils differ. Field results indicate a lack of organic matter in the soils, but laboratory tests show little difference between the two kinds of soil in this respect. Heavy fertilization benefits the plants on the poorer soils, but it does not completely remedy the defect; sulphur, likewise, is beneficial when the soil reacts neutrally but is not a complete remedy. Such factors as soil aeration, moisture, temperature, plant nutrient content, and chemical reaction have been used as a basis for determining the suitability of a soil for pineapples before planting, and the work has progressed sufficiently to permit drawing conclusions in the near future. The problem of making an unsuitable soil suitable is being solved by noting the effect of drainage, subsoiling, and the application of organic matter and various inorganic elements on the crop. The results would seem to indicate that subsoiling, in which the soil is brought from a depth of 18 or more inches to the surface, usually benefits the plant. The application of organic matter, such as manure, straw, or muck, has been beneficial in all cases. Sulphur can be recommended for use on a soil containing little limestone, but not where coral sand is the predominating constituent.

FERTILIZERS

Results of experiments in the field and with plants grown in water and sand cultures indicate that no fertilizers are needed during the first four to eight weeks after planting. After that time nitrogen and potash in large quantities are needed, as is shown by the difference in growth of plants receiving these elements in varying quantities. Phosphorus, on the other hand, does not seem to be of so much importance. The most suitable form of nitrogen was also investigated for the reason that growers have found sulphate of ammonia desirable, and nitrate of soda undesirable, for the pineapple plant. This has led to the erroneous belief that the pineapple prefers nitrogen in form of ammonia. Water-culture tests at the station show that the pineapple plant removes no ammonia from the solutions, but readily absorbs other forms of nitrogen, especially potassium nitrate. Results of studies, made to learn why dried blood and cottonseed meal are frequently ineffectual as fertilizers, showed no failures due to a lack of nitrification. Nitrates may be present. but the plants do not thrive as they do with sulphate of ammonia. Sulphur, when used in combination with dried blood, apparently reme-

dies the defect, which would seem to indicate among other things that soil acidity is a limiting factor. This, however, has yet to be determined.

REPORT OF THE PLANT PATHOLOGIST

By C. M. Tucker

COCONUT BUD ROT

In September, 1923, investigations were undertaken to determine the organism causing coconut bud rot, as well as the factors contributing to its dissemination, virulence, and incubation period, and

Fig. 13.—Early indication of coconut bud rot

the practicability of eradicating diseased palms as a means of control. A survey of the western coast of the island, from Mayaguez to Rincon, revealed about 700 cases of bud rot. Palms were attacked in all stages of growth, those in sheltered location proving the most susceptible to the disease. Infection occurs most frequently during the rainy season.

The first symptom of bud rot is the death of the young emerging leaf, followed by other young leaves. (Fig. 13.) These are soon broken over by the wind and hang, tips downward, finally falling from the central column, leaving, surrounding the apex of the trunk, a fringe of healthy, nearly horizontal green leaves which gradually fall away until defoliation is complete. (Fig. 14.) Examination of

leaves that are removed with the petioles from the trunk usually discloses the presence of a dark-brown decayed spot near the base of one of the inner leaves. (Fig. 15.) Experiments have shown that infection may occur near the base of the leaf and spread through the intervening sheaths, increasing in activity as the tissue encountered becomes soft and watery; or it may spread from the youngest leaves to the bud and spongy generative tissue beneath, converting both into a soft, watery, malodorous mass.

The earliest attempts to isolate the causal organism gave nearly pure cultures of a bacterium closely resembling *Bacillus coli*. Experiments in which the bud was inoculated with cultures of the

FIG. 14.—Coconut tree in advanced stage of bud rot

organism resulted in the emergence, six weeks later, of diseased leaves which were not typical of field cases of bud rot. Several of the young leaves were badly spotted and deformed, but later leaves were healthy and normal. Check trees, wounded as for inoculation but not inoculated, produced the same type of apparently diseased leaves, after which normal leaf production was resumed.

In February, 1924, a species of Phytophthora was isolated from a palm in the earliest observable stage of bud rot. The fungus was grown in pure culture and used for inoculating healthy palms. Typical cases of bud rot followed inoculation of both wounded and unwounded palms. The fungus is probably of the *P. faberi* group, no oospores having been observed. The conidiospores have an aver-

age length of 50.4 microns and an average diameter of 30.23 microns, corresponding closely to measurements of *P. faberi*. The chlamydospores have an average diameter of 32.96 microns, and are considerably smaller than those of *P. faberi*, corresponding more closely to the chlamydospores of *P. palmivora* as described by Butler.

Forty-two diseased palms were cut and burned in a grove in the Peña Cortada district, Mayaguez, in November, 1924, to determine the possibility of eradicating the disease in a given section by destroying the sources of infection. Six new cases appeared within the next six months, five being in a group of closely planted young trees that were sheltered by older palms and by houses. Each case occurred within 30 feet of the spot occupied by one of the 42 diseased

FIG. 15.—But-rot infected coconut tree. Leaf bases removed to show point of attack

palms. The trees were cut and the buds burned. No new cases of infection were apparent four months later.

A ROOT DISEASE OF VANILLA

A Fusarium has been repeatedly isolated from diseased vanilla roots. Twenty pots were filled with soil from a vanilla planting where the plants were killed by the disease two years ago. Half of the pots were autoclaved and all were planted with vanilla cuttings. Those in the autoclaved soil made a healthy growth, whereas those in the unsterilized soil failed to start, the roots being attacked and killed as soon as they appeared. Experiments using a corn-meal culture of the fungus to inoculate cuttings growing in coconut fiber

resulted in the infection of 50 per cent of the plants. Normally the disease appears in plantings about the fourth year, the accumulating acid from decaying organic matter probably creating favorable conditions for its development. An experiment was started with 200 plants to determine the efficiency of liming in neutralizing the acid and preventing the growth of the fungus in the soil. Growers have been advised to burn infected plants in situ, since the fungus spores may be disseminated from the diseased aerial roots.

LEAF-SPOTTING FUNGI

Morphological studies are being made of leaf-spotting fungi (*Cercospora* and *Helminthosporium* spp.). Thirty-five species of the fungi have been examined, and drawings and biometric measurements made of the conidia and conidiospores, and descriptions written. The *Helminthosporium* spp. are being grown in cultures. Several new features have been discovered.

SCAB-RESISTANT GRAPEFRUIT

The progeny of Duncan, a commercially valuable variety, crossed with Triumph, a relatively scab-resistant variety, has as yet produced no fruit. Seedlings producing fruit of commercial value will be grafted on rough lemon stock in a location where the scab is especially prevalent to determine their disease resistance.

BANANA WILT

A planting of Chamaluco bananas, selected for resistance to the banana-wilt organism (*Fusarium cubense*), failed to fruit this year. Although the plants have been limed and fertilized, they invariably succumb to the disease before blossoming. The planting will be destroyed and the infected area devoted to varieties which are thought to be resistant to wilt.